WHAT IS CLAIMED IS:

1. An optical navigation sensor device comprising:

an image pixel array for calculating analog voltage values of pixels thereof respectively corresponding to relative intensities of reflected light beams incident to the pixels from a support surface, on which the sensor device is laid;

an analog/digital (A/D) converter for converting the analog voltage values of the pixels received thereto into corresponding digital voltage values, respectively, thereby producing a current image of the support surface;

a pre-processor for sequentially receiving the digital voltage values from the A/D converter for all pixels of the current support surface image in accordance with a predetermined timing signal, performing a pre-process for the current support surface image, thereby producing a pre-processed current image consisting of pixels each having a 2-bit digital voltage value, and extracting, from the pre-processed current image, a pre-processed current central image having a predetermined pixel array; and

a motion coordinate calculator for setting, as X/Y-axis reference image candidates, the pre-processed current central image received from the pre-processor, calculating an X-axis motion vector while overlapping a previously-set X-axis reference image with the pre-processed current image, thereby

calculating an X-axis motion coordinate value of the pre-processed current image, and calculating a Y-axis motion vector while overlapping a previously-set Y-axis reference image with the pre-processed current image, thereby calculating a Y-axis motion coordinate value of the pre-processed current image.

2. The optical navigation sensor device according to claim 1, wherein the pre-processor converts the digital voltage values of respective pixels of the current image sequentially received from the A/D converter into corresponding 2-bit values, respectively, by comparing a sum of the digital voltage value of a current one of the current image pixels, currently received, and the digital voltages values of the pixels vertically adjacent to the current pixel with a sum of the digital voltage value of the pixel horizontally spaced apart from the current pixel by a predetermined distance and the digital voltage values of the pixels vertically adjacent to the horizontally spaced pixel, thereby determining, based on the result of the comparison, one bit of the 2-bit value of the current pixel, and comparing a sum of the digital voltage value of the current pixel and the digital voltages values of the pixels horizontally adjacent to the current pixel with a sum of the digital voltage value of the pixel vertically spaced apart from the current pixel by a predetermined distance, and the digital voltage value of the pixels horizontally adjacent to

the vertically spaced pixel, thereby determining, based on the result of the comparison, the other bit of the 2-bit value of the current pixel.

3. The optical navigation sensor device according to claim 2, wherein the pre-processor applies a weight to the pixels horizontally or vertically adjacent to the current pixel upon summing the digital voltage value of the current pixel and the digital voltage values of the adjacent pixels.

4. The optical navigation sensor device according to claim 1, wherein the motion coordinate calculator comprises:

an X-channel reference unit for storing the pre-processed current central image received from the pre-processor as an X-axis reference image candidate for calculation of motion coordinate values of a next pre-processed image to be subsequently inputted, and setting the X-axis reference image candidate as an X-axis reference image for the next pre-processed image when an X-axis motion vector of the pre-processed current image corresponding to an X-axis motion has a value other than zero, while maintaining the previously-set X-axis reference image when the X-axis motion vector of the pre-processed current image has a value of zero;

a Y-channel reference unit for storing the pre-processed current central image received from the pre-processor as a Y-

axis reference image candidate for the calculation of the motion coordinate values of the next pre-processed image, and setting the Y-axis reference image candidate as a Y-axis reference image for the next pre-processed image when a Y-axis motion vector of the pre-processed current image corresponding to a Y-axis motion has a value other than zero, while maintaining the previously-set Y-axis reference image when the Y-axis motion vector of the pre-processed current image has a value of zero;

an image comparing unit for receiving the pre-processed current image from the pre-processor, sequentially overlapping, a predetermined number of times, the X-axis reference image stored in the X-channel reference unit with the pre-processed current image in different overlap states, comparing the overlapped images with each other in every overlap state, thereby calculating the number of pixels present in the pre-processed current image while having the same bit values as those of the pixels included in the X-axis reference image in every overlap state, sequentially overlapping, a predetermined number of times, the Y-axis reference image stored in the Y-channel reference unit with the pre-processed current image in different overlap states, and comparing the overlapped images with each other in every overlap state, thereby calculating the number of pixels present in the pre-processed current image while having the same bit values as those of the pixels

included in the Y-axis reference image in every overlap state; and

a motion vector unit for setting, as the X-axis motion vector of the pre-processed current image, an X-axis coordinate value of the X-axis reference image in the overlap state in which the number of pixels present in the pre-processed current image while having the same bit values as those of the pixels included in the X-axis reference image is maximal, thereby calculating the X-axis motion coordinate value of the pre-processed current image, and setting, as the Y-axis motion vector of the pre-processed current image, a Y-axis coordinate value of the Y-axis reference image in the overlap state in which the number of pixels present in the pre-processed current image while having the same bit values as those of the pixels included in the Y-axis reference image is maximal, thereby calculating the Y-axis motion coordinate value of the pre-processed current image.

5. An image processing method using a 2-dimensional sequential image process, comprising the steps of:

(A) storing, by a pre-processor, digital voltage values of respective pixels of an image received from a pre-processor via an analog/digital (A/D) converter in a memory;

(B) performing, by the pre-processor, a pre-process for the digital voltage values of respective pixels sequentially

received from the memory in accordance with a predetermined timing signal, thereby producing a pre-processed current image, and extracting a pre-processed current central image from the pre-processed current image;

(C) determining, by a motion coordinate calculator, whether or not the pre-processed current central image is to be set as X/Y-axis reference images for calculation of motion coordinate values of a next pre-processed image, based on a motion vector of the pre-processed current image; and

(D) comparing, by the motion coordinate calculator, the pre-processed current image received from the pre-processor with X/Y-axis reference images respectively stored in X/Y-channel reference units, thereby calculating X/Y-axis motion coordinate values of the pre-processed current image.

6. The image processing method according to claim 5, wherein the step (A) comprises the steps of:

(A-1) converting, by an image pixel array, reflected light beams inputted to respective pixels of the image pixel array from a support surface, on which an optical mouse is laid, into analog voltage values, respectively;

(A-2) sending, by the image pixel array, the analog voltage values of the pixels to the A/D converter;

(A-3) converting, by the A/D converter, the analog voltage values of the pixels received from the image pixel

array into corresponding digital voltage values, respectively;

(A-4) sensing the digital voltage values of the pixels from the A/D converter to the pre-processor; and

(A-5) storing, by the pre-processor, the digital voltage values of the pixels received from the A/D converter in the memory.

7. The image processing method according to claim 5, wherein the step (B) comprises the steps of:

(B-1) sequentially receiving, by the pre-processor, the digital voltage values of the pixels from the memory in accordance with the predetermined timing signal;

(B-2) setting, by the pre-processor, a basic image matrix consisting of a current one of the pixels to be currently converted into a predetermined bit value, and pixels adjacent to the current pixel;

(B-3) performing, by the pre-processor, a column-to-column/row-to-row calculation for the digital voltage values of the pixels included in the basic image matrix, thereby converting the digital voltage value of the current pixel into a 2-bit digital voltage value;

(B-4) producing, by the pre-processor, a pre-processed current image having a pixel array consisting of pixels respectively having 2-bit digital voltage values each obtained at the step (B-3); and

(B-5) extracting, by the pre-processor, a pre-processed current central image having a predetermined pixel array from the pre-processed current image.

8. The image processing method according to claim 7, wherein the step (B-3) comprises the steps of:

(B-3-1) comparing a sum of the digital voltage value of a current one of the current image pixels, currently received, and the digital voltages values of the pixels vertically adjacent to the current pixel with a sum of the digital voltage value of the pixel horizontally spaced apart from the current pixel by a predetermined distance and the digital voltage values of the pixels vertically adjacent to the horizontally spaced pixel, thereby determining, based on the result of the comparison, one bit of the 2-bit value of the current pixel; and

(B-3-2) comparing a sum of the digital voltage value of the current pixel and the digital voltages values of the pixels horizontally adjacent to the current pixel with a sum of the digital voltage value of the pixel vertically spaced apart from the current pixel by a predetermined distance, and the digital voltage value of the pixels horizontally adjacent to the vertically spaced pixel, thereby determining, based on the result of the comparison, the other bit of the 2-bit value of the current pixel.

9. The image processing method according to claim 8, wherein a weight is applied to the pixels horizontally or vertically adjacent to the current pixel upon summing the digital voltage value of the current pixel and the digital voltage values of the adjacent pixels.

10. The image processing method according to claim 7, wherein the basic image matrix is a 3 x 3 matrix.

11. The image processing method according to claim 5, wherein the step (C) comprises the steps of:

(C-1) calculating, by the motion coordinate calculator, an X-axis motion of the pre-processed current image;

(C-2) determining, by the motion coordinate calculator, whether or not an X-axis motion vector corresponding to the calculated X-axis motion has a value of zero;

(C-3) maintaining, by the motion coordinate calculator, the reference image previously set in an X-channel reference unit when it is determined at the step (C-2) that the X-axis motion vector has a value of zero;

(C-4) replacing, by the motion coordinate calculator, the reference image previously set in the X-channel reference unit with the pre-processed current central image when it is determined at the step (C-2) that the X-axis motion vector has

a value other than zero;

(C-5) calculating, by the motion coordinate calculator, a Y-axis motion of the pre-processed current image;

(C-6) determining, by the motion coordinate calculator, whether or not a Y-axis motion vector corresponding to the calculated Y-axis motion has a value of zero;

(C-7) maintaining, by the motion coordinate calculator, the reference image previously set in a Y-channel reference unit when it is determined at the step (C-6) that the Y-axis motion vector has a value of zero; and

(C-8) replacing, by the motion coordinate calculator, the reference image previously set in the Y-channel reference unit with the pre-processed current central image when it is determined at the step (C-6) that the Y-axis motion vector has a value other than zero.

12. The image processing method according to claim 5, wherein the step (D) comprises the steps of:

(D-1) receiving, by the motion coordinate calculator, the pre-processed current image from the pre-processor;

(D-2) sequentially overlapping, a predetermined number of times, by the motion coordinate calculator, the X-axis reference image stored in the X-channel reference unit with the pre-processed current image in different overlap states;

(D-3) comparing, by the motion coordinate calculator, the

overlapped images with each other in every overlap state, thereby calculating the number of pixels present in the pre-processed current image while having the same bit values as those of the pixels included in the X-axis reference image in every overlap state;

(D-4) setting, by the motion coordinate calculator, as the X-axis motion vector of the pre-processed current image, an X-axis coordinate value of the X-axis reference image in the overlap state in which the number of pixels present in the pre-processed current image while having the same bit values as those of the pixels included in the X-axis reference image is maximal;

(D-5) calculating, by the motion coordinate calculator, the X-axis motion coordinate value of the pre-processed current image, based on the set X-axis motion vector;

(D-6) sequentially overlapping, a predetermined number of times, by the motion coordinate calculator, the Y-axis reference image stored in the Y-channel reference unit with the pre-processed current image in different overlap states;

(D-7) comparing, by the motion coordinate calculator, the overlapped images with each other in every overlap state, thereby calculating the number of pixels present in the pre-processed current image while having the same bit values as those of the pixels included in the Y-axis reference image in every overlap state;

(D-8) setting, by the motion coordinate calculator, as the Y-axis motion vector of the pre-processed current image, a Y-axis coordinate value of the Y-axis reference image in the overlap state in which the number of pixels present in the pre-processed current image while having the same bit values as those of the pixels included in the Y-axis reference image is maximal; and

(D-9) calculating, by the motion coordinate calculator, the Y-axis motion coordinate value of the pre-processed current image, based on the set Y-axis motion vector.